REMARKS

In the non-final Office Action mailed February 13, 2004, the Examiner rejected claims 1-18 and 20 on obviousness grounds. Applicants note that, in the previous office action mailed August 19, 2003, claims 1-18 and 20 were rejected as being allegedly anticipated. In both office actions, the Examiner indicated that claim 19 would be allowable if rewritten in independent form. In response, Applicants request reconsideration of all pending claims 1-20 in view of the amendments and the arguments below.

Claim Rejections 35 U.S.C. § 103 – Claims 1-19

The Examiner rejected claims 1-18 under 35 U.S.C. § 103(a) as being unpatentable over DeMoney in view of Gupta et al. The Examiner also objected to claim 19 as being dependent on a rejected base claim, namely claim 13. Applicants submit that pending independent claims 1 and 13 each define an invention that is patentable over the combination of the cited references. Applicants' identification of the differences between the claimed invention and the cited references should not be taken as an admission that either reference is properly considered prior art under any provision of 35 U.S.C. §§ 102 or 103.

Applicants' claims 1 and 13 are directed to characterizing the performance of a data handling system (DHS) having a cache. In the method of claim 1, commands for a set of data blocks that are large relative to the size of the cache dedicated for the commands are sent to the DHS. Applicants disclose that a block of data is large relative to the size of the cache, for example, if the block size is large enough to cause the cache to be unable to mask the worst-case performance of the disc drive. (Spec., p. 6, lns. 19-23.) A block service time for each large data block is recorded and compared to a first threshold. The DHS is scored based on the comparison of the block service time to the first threshold. Similarly, the system of claim 13 is capable of carrying out a method according to claim 1. The system includes a host computer for providing commands that are serviced by the DHS, and an interface for communicating the commands from the host computer to the DHS.

One of the cited references, DeMoney, discloses a system and a method for tuning storage systems that are used in video/audio playback of multiple continuous media streams. (Abstract, Background.) In DeMoney, a video storage manager must control admission of new continuous streams to ensure that the aggregate of the guaranteed stream rates does not exceed the aggregate storage bandwidth allocated for continuous media streams. (Col. 17, lns. 22-27.) <u>Before any streaming is begun</u>, the storage systems are characterized to determine their performance or bandwidth. (Col. 17, lns. 26-28.) In DeMoney, the performance may be characterized with a synthetic load that reflects the characteristics of a <u>typical</u> load. (Col. 17, lns. 41-43.) DeMoney teaches that this synthetic load is created by allocating blocks in a zoned random manner so that sequential file block allocations are chosen from random positions within a zone alternating between an (sic) I/O disk zone. (Col. 17, ln. 65 - col. 18, ln. 1.) Thus, a <u>representative</u> load may be constructed by constraining the file system to allocate sequential blocks in a zoned random manner. (Col. 17, lns. 46-48.) DeMoney teaches that this may be done by dividing the disk block address range into two halves and choosing sequential file block allocations from random positions within a zone alternating between the two zones. According to DeMoney, disk performance may be characterized using this synthetic load and then de-rated to provide margin. (Col. 17, lns. 48-53.)

The other cited reference, Gupta, discloses methods and systems for delivering over-size data objects, such as continuous streaming media data files. (Para. 0011.) Gupta defines an "over-sized object" as a data object that has an object size that is so large relative to the available buffer/cache memory size of a given information management system that caching the entire data object is not possible. (Para. 0044.) Gupta discloses a method that may optionally be implemented to validate I/O performance characteristics. (Para. 0161.) <u>Before a storage device is put into service</u>, I/O performance characteristics such as <u>average</u> access time and average transfer rate may be validated. (Para. 0162.) According to Gupta:

> A disk drive performance validation may be conducted on each individual disk drive <u>before</u> the disk drive is ready to be put in service, and may employ random disk sector sequences to measure how many IOPS/sec may be achieved for several different <u>standard block sizes</u> (e.g., at least two block sizes from about 64 kb to about 1 Mb).

> In one exemplary embodiment, a disk drive may be substantially fully loaded by using a sequence of random read requests (e.g. about 1000 random read requests) that may be generated at the currently-used block size (e.g., a block size of about 64 KB). The total measured service time ("T1"), i.e., the time between submittal of the first read request to the time when all the read requests are completed by the disk, is measured and recorded. The measured total service time T1 may then be compared to an estimated value of total service time ("Te") that may be determined using, for example, the assumed <u>average</u> access time AA and the assumed <u>average</u> transfer rate TR (as well as the total number of I/O's and the block size) in a manner as follows. (emphasis added) (Para. 0162-0163.)

Gupta repeatedly teaches that the measured time T1 is used to validate the assumed <u>average</u> access time and assumed <u>average</u> transfer rate. (Paras. 0168, 0173-0174.)

Applicants submit that neither DeMoney nor Gupta anticipates any of the Applicants' claims 1 or 13. Based upon the second office action, it appears that the Examiner agrees. The Examiner stated, "DeMoney differs from the claimed invention in not specifically teaching the steps of comparing the block service time to the first threshold." (Office Action, p. 3.) Applicants submit that neither cited reference discloses each and every element of Applicants' claims. For example, neither reference discloses characterizing performance of a DHS having a cache by sending commands for a set of data blocks that are large relative to a size of the cache dedicated for the commands.

Neither do DeMoney or Gupta, either alone or in combination, render claim 1 or claim 13 obvious. Applicants' claimed method (claim 1) and system (claim 13) provide capabilities that the cited references not only cannot provide, but capabilities that the cited references do not even contemplate. For example, Applicants' claimed invention could identify worst-case performance of the DHS that the systems in the cited references could not. Instead of performing a worst-case test, the cited references teach characterizing or validating performance in ways that are very different from Applicants' claimed invention. DeMoney teaches using a synthetic load that reflects the characteristics of a <u>typical</u> load by dividing the disk block address ranges into two halves and choosing from random positions alternating between two zones. Gupta teaches use of

multiple (e.g. 1000) read requests of <u>standard</u> block sizes to determine an <u>average</u> access time. However, neither reference discloses characterizing performance using data blocks that are large relative to the cache. Thus, neither reference anticipates Applicants' claims 1 or 13.

In contrast to the worst-case performance conditions achieved by Applicant's claimed method and system, the cited references teach nominal (i.e., "typical," "average," and "standard") operating conditions. This distinction is important because in many applications, "worst-case" performance is critical while "average" performance is irrelevant. (Spec., p. 1, ln. 24- p.2, ln. 3.) Some data handling systems, such as streaming audio/video systems, require that the DHS performance not fall below at least at a certain minimum level during a given interval, and the application gains little or no benefit from performance above that minimum level at any time or on average. (Spec., p. 1, lns. 17-21.) The cited references do not teach performance validation or performance characterization under worst-case conditions. As such, they cannot determine whether a data handling system will meet or exceed the required minimum level of performance for all potential situations. (Spec., p. 2, lns. 22-26.)

The performance validation and performance characterization disclosed by the cited references do not teach or suggest detecting worst-case conditions for time-critical data handling systems. In streaming data handling systems, worst-case operating conditions can arise from several sources. One exemplary source is mechanical vibration. If video data is accessed from a disk drive, vibrations may cause the read/write head to go off-track. As such, read errors are more likely, and one or more re-tries may be required to properly read the data from the disk. While waiting for the disk to make a revolution to begin each re-try, valuable time may be lost, and in the worst-case, the disk drive is unable to supply the data fast enough. In that case, the video may be interrupted. A second exemplary source of worst-case conditions that may not be detected using the teachings of the cited references relates to the geometry of tracks in a disk drive. A disk drive may require, for example, 8 revolutions to read 1 MB of data on tracks near the inner diameter (ID) of the disk, whereas only 4 revolutions may be required to read 1 MB of data on tracks near the outer diameter (OD) of the disk. If an average measurement is made of random data, the average access time may correspond to 6 revolutions/MB. However, if a block

of data is near the ID, the actual access time may be significantly greater than the expected average for a period of time. If during that "slow" period the disk drive is unable to keep up with the minimum data rate, a streaming failure may occur. If these, or other sources, of delay are infrequent or intermittent, a validation or characterization using an averaging method over many cycles might not detect that streaming operation could fail under some conditions. The above examples illustrate that average access methods are inadequate for some (e.g., time-critical) data handling system applications. Accordingly, Applicants submit that the combination of the cited references cannot achieve the advantages obtained by the Applicants' claims 1 and 13. As such, Applicants request that the Examiner remove the obviousness rejections from those claims.

In the light of the foregoing, Applicants further submit that the Examiner has cited reasons for rejecting Applicants' claims that are based on improper interpretations of the cited references. In the Office Action (at p. 2), the Examiner relied on DeMoney (col. 3, lns. 7-12) for teaching the following limitation in Applicants' claim 1: "sending commands to the data handling system for a set of data blocks that are large relative to a size of the cache." Applicants respectfully submit that the passage cited by the Examiner cannot fairly be read to stand for any limitation in Applicants' claim. The passage cited by the Examiner states,

> As shown in FIG. 1, the stream one has a larger block size and thus a higher data rate than stream two. When streams are recorded to disk using a constant/time variable data scheduling mechanism, the placement of data on the disks is rate dependent. (DeMoney, col. 3, lns. 7-12.)

Applicants respectfully point out that this statement is irrelevant to any limitation in any of Applicants' claims. This statement compares the block sizes of two data streams (see Fig. 1), but this has nothing to do with the size of a data block relative to a cache, which claim 1 requires. Moreover, the Examiner appears to improperly conflate two different modes of operation, namely streaming operation with performance characterization. Applicants respectfully point out that DeMoney discusses performance characterization in Col. 17. In the discussion of performance characterization, DeMoney does not teach or suggest sending commands to the

DHS for a set of data blocks that are large relative to the size of a cache, as required by Applicants' claim 1. Instead, DeMoney teaches a synthetic load that is representative (as described above). Thus, the Examiner has not shown that the cited references meet one of the required elements of Applicants' claims 1 and 13. Because all of the Examiner's rejections rely on the above-cited passage for teaching a required element of the claim, Applicants request that all the rejections be removed.

In the Office Action (at p. 3), the Examiner alleged that "Gupta teaches a validation of system I/O performance characteristics by comparing the different block sizes, including oversize data block ([0011])." By relying on Gupta's teaching of "over size data," Applicants respectfully submit that the Examiner again improperly conflates streaming operation with performance validation. Gupta uses "over size data" to refer to delivering data when the information system is in service, i.e., delivering streaming data. However, to refer to blocks of data for performance validation, Gupta explicitly chose to define a different term, namely "standard block size." Gupta directly states that validation occurs <u>before</u> a storage device is put into service. (Para. 0162.) As such, Gupta's references to "over-size data" apply only during streaming operation are therefore not relevant during performance validation. Moreover, Gupta explicitly discloses using only "standard" block sizes for performance validation. (Para. 0162.) Gupta's examples of standard block sizes for performance validation (paras. 0162, 0163, and 0174) clearly differ from Gupta's definition of "over size data" (Para. 0044). As such, Applicants submit that Gupta does not use "over size data" in conjunction with performance validation testing. To the extent that the Examiner relied on Gupta teaching performance validation using over sized data to meet any element of Applicants' claims, Applicants respectfully traverse.

For at least the foregoing reasons, the cited references in combination do not teach every element of Applicants' claims 1 or 13. Therefore, Applicants submit that independent claims 1 and 13 each define an invention that is patentable over the cited references. Accordingly, claims

2-12, which depend either directly or indirectly from claim 1, and claims 14-19, which depend from claim 13, each define an invention that is patentable over the cited references. Accordingly, Applicants request that claims 1-19 be allowed.

Claim Rejection 35 U.S.C. § 103 – Claim 20

The Examiner rejected claim 20 under 35 U.S.C. § 103(a) as being unpatentable over DeMoney in view of Gupta et al. Applicants submit that pending independent claim 20 defines an invention that is patentable over the combination of the cited references. Applicants' identification of the differences between the claimed invention and the cited references should not be taken as an admission that either reference is properly considered prior art under any provision of 35 U.S.C. §§ 102 or 103.

Applicants respectfully traverse Examiner's rejection of independent claim 20 because the claim has not yet been properly examined. Applicants submit that claim 20 is in proper means-plus-function format. As such, this claim deserves analysis by the Examiner using the Guidelines for examination set forth in M.P.E.P. §§ 2181-2186 (2003). These Guidelines guide the examination of claims written in accordance with 35 U.S.C. §112, ¶6. Accordingly, the Examiner has the burden of determining patentability of these claims according to the Guidelines.

Applicants respectfully request that the Examiner examine claim 20 according to the Guidelines. After a proper examination of the claim in view of the remarks made above with respect to independent claims 1 and 13, Applicants submit that the Examiner will agree that claim 20 is allowable. Accordingly, Applicants request that claim 20 be allowed.

Conclusion

Applicants submit that claims 1-20 are now in condition for allowance. Accordingly, Applicants respectfully request that the Examiner issue a timely Notice of Allowance in this case for all of claims 1-20.

Applicants believe that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue, or comment does not signify agreement with or concession of that rejection, issue, or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

Please charge deposit account 06-1050 in the amount of $110.00 the Petition for Extension of Time fee. Please apply any other charges or credits to deposit account 06-1050.

Respectfully submitted,

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Craige Thompson
Craige O. Thompson
Reg. No. 47,990

Fish & Richardson P.C., P.A.
60 South Sixth Street
Suite 3300
Minneapolis, MN 55402
Telephone: (612) 335-5070
Facsimile: (612) 288-9696

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